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line λ 6302.71, when observed at right angles to the lines of force in the laboratory, is a triplet.[1] In the spot spectrum it also appears as a triplet. Since many other lines also appear as triplets in the spot spectrum, it is evident that the light of the spot is partly longitudinal and partly transverse.

A comparison of the separations of spot doublets with those of the same doublets observed in the laboratory gives, in the case of four iron lines, a remarkably close agreement for the relative separations. In the case of titanium, and other elements extending through a considerable range of level in the Sun, there are greater divergences, probably due to the rapid change in the strength of the field in passing upward through the spot. The *D* and *b* lines in the spot spectrum, which represent comparatively high levels, show but little effect of a magnetic field. Hence at the distance of the Earth the spot-field would be quite inappreciable, even with very delicate instruments. The strength of the field in spots, at the level represented by the iron doublets, is about 2900 gausses.[2]

It seems possible that the Sun itself, on account of its axial rotation, may also have a magnetic field. The polar rays of the corona, which resemble the lines of force in a magnetic field, long ago suggested this idea to several astronomers. I have accordingly photographed the spectrum of points near the Sun's pole through a Nicol (used with a rhomb) set at various angles. Some of the lines which are double or triple in the spot spectrum appear to undergo slight displacements, with reference to telluric lines, when the Nicol is rotated. I am now endeavoring to determine whether these shifts can be of instrumental origin. If not, they may be produced by the Sun's field.

GEORGE E. HALE.

MT. WILSON SOLAR OBSERVATORY, December, 1908.

" DOUBLE-STAR ASTRONOMY."

In No. 120 of these *Publications* I called attention to a series of papers with the title "Double-Star Astronomy," that were appearing in the *Observatory*. Mr. LEWIS has now reprinted this series under the same title in a handy pamphlet[1] of forty-six pages, which forms an excellent introduction to the study of double stars.

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[1] This was at first supposed to be an asymmetrical triplet, but later and better photographs show it to be symmetrical, both in spot and laboratory.

[2] Since the above was written I have obtained photographs of the spectrum of a large spot showing a much stronger field.

It contains a brief history of the subject, short notices of all the more important double-star observers and publications, the formulæ and examples for two methods of computing an orbit, and some miscellaneous formulæ that are of value.

Of special interest to the present writer are the sections on the separating power of telescopes, on the application of photography to double-star work, and on personal equation. The last-named topic is one on which considerable difference of opinion exists, and some will undoubtedly disagree with the author's conclusions, though I consider them sound doctrine.

As Mr. LEWIS's book will be widely read it seems worth while to correct one statement. On page 23 it is stated, "AITKEN and HUSSEY rarely keep a pair separated over 6″." The numeral should be 5″. Out of 3,237 new pairs so far published only twenty-five have measured distances exceeding 5″.00, and thirteen of these do not exceed 5″.25. Only two pairs (Hu 738, 6″.50, magnitudes 6.3 — 11.5; and Hu 748, 6″.04, magnitudes 6.2 — 12.8) exceed 6″.00. This statement, of course, applies to the closer pair of the system. Occasionally measures are given of one or more additional stars at greater distances.

Another publication of interest to double-star observers is Professor LOHSE's paper, "Doppel Sterne,"[2] published by the Potsdam Observatory. In addition to a good series of measures of selected pairs made with the 11-inch refractor, Professor LOHSE gives the results of his investigations of the motion in thirty-two systems. In a few instances he concludes that no improvement can be made upon existing orbits, but in most instances he computes a new orbit by graphical methods, which in a number of cases he corrects by a least-squares solution. It happens that I have later measures of twenty-two of the stars investigated, and I have been interested to see how nearly my measures are represented by the new orbits. In eleven pairs, the residuals are within the limit of error of observation, in five others (including β 648, of which there is no other orbit) they are fairly satisfactory, but in the remaining six (β 524, β 883, OΣ 235, *ξ Scorpii*, β 416, and 85 *Pegasi*) the residuals in angle average over 23°, and one of the distance residuals, in β 416, exceeds 0″.4.

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[1] "Double-Star Astronomy," by T. LEWIS, Sec. R. A. S. Taylor & Francis, London, 1908. Two shillings.

[2] See these *Publications*, **20**, 274, 1908.

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Note on the Binary Star *ξ Scorpii*.

Two orbits for this well-known binary system have recently been published, one by DOBERCK[1] and one by LOHSE.[2] Both are based on practically the same data as my orbit published in 1905,[3] and both computers have adopted the assumption made by me, that the periodic time is about 44.5 years instead of over one hundred years.

The three sets of elements do not differ greatly, but the motion in the apparent orbit has been so rapid during the past three years that even slight variations in the elements lead to decided changes in the residuals derived by comparing the computed and observed positions.

The following tabulation gives my measures made after my orbit was published, and the residuals derived by comparing them with the three sets of elements:—

Date.	θ_0	ρ_0	Nights.	(O–C) A.		(O–C) D.		(O–C) L.	
1905.50	13°.8	0″.18	3	− 5°.6	+0″.02	−19°.1	+0″.03	−14°.8	+0″.02
1906.38	68 .7	0 .23	4	−13 .3	+0 .02	−25 .6	+0 .03	−29 .6	±0 .00
1907.40	108 .2	0 .32	4	− 9 .4	+0 .01	−17 .4	+0 .01	−21 .3	−0 .05
1908.48	125 .8	0 .36	2	−10 .4	−0 .06	−15 .6	−0 .07	−18 .8	−0 .14

These residuals put the correctness of the short period of revolution beyond question, and indicate that the other elements of the orbit are fairly well determined. Further computation will not be profitable until the companion star has passed nearly through the second quadrant.

November, 1908. R. G. AITKEN.

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[1] *Astronomische Nachrichten*, **174**, 257, 1907.

[2] *Pub. d. Astrophysik. Observ.* zu Potsdam, **20**, Pt. I, 124, 1908.

[3] *Lick Observatory Bulletin*, No. 107. 1905.